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ABSTRACT

An intelligent advisor system is an instructional technology designed to further the transfer of knowledge by intervening when the user of any application software performs transfer tasks. In Quebec (Canada), the teaching of music is regulated by a mandatory curriculum which is divided into six modules; the intelligent advisor system, MUSIC, relates to the creation module of the ninth grade. Its purpose is to help a student while he or she uses a musical writing software to compose a melody. The advisor MUSIC performs three types of instructional transactions: (1) explanations requested by a student; (2) comments on the student's composition; and (3) comments on compositions made by the advisor. Twenty-seven ninth grade students from Quebec high schools participated in a study to determine if MUSIC favors the transfer of knowledge. It was found that the transfer of knowledge improved and that MUSIC does what is impossible for the human teacher of an average class--perform concurrently fast, individualized, detailed, remedial, and corrective explanations and feedback. (Contains 13 references.) (AEF)

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ED 393 425

INTELLIGENT ADVISOR SYSTEMS AND TRANSFER OF KNOWLEDGE

by
Marie-Michèle Boulet

Introduction

In Quebec, the teaching of music is regulated by the Quebec Ministry of Education. That corresponds to a mandatory music curriculum (Ministère de l'Éducation, 1981) divided into six modules: creation, execution, graphics, musical language, musical literature, and sound environment. This research concerns the creation module. The main objective of this module is to allow the transfer of knowledge of the musical language elements. Composing melodies is the activity proposed by the Ministry of Education (Ministère de l'Éducation, 1983). Therefore, in accordance with Burns (1988), the Ministry of Education considers that the creative process not only synthesizes previous learning but also elevates the mind into a higher stage of reasoning--the problem solving stage. Moreover, in accordance with Moore (1990), the tasks are conceived as "musical problem solving" within a context of implicit as well as explicit musical parameters (an incomplete melody). Figure 1 shows the variety of exercises proposed to students which correspond to musical composition activities proposed in "Musicontact 3," a book approved by the Quebec Ministry of Education (Fournier, Milot, Richard, Béchard, & De Melo, 1986).

The Technology

An intelligent advisor system is an instructional technology especially designed to further the transfer of knowledge. It is an adaptive system aimed at intervening when the user of any application software performs transfer tasks (Boulet, 1992). According to Leshin, Pollock, and Reigeluth (1992), transfer tasks have great variation from one performance to another. They cannot easily be broken down into steps because the activity varies each time the task is performed. To compose a melody is a transfer task.

An intelligent advisor system is a technology to be used after the initial learning of concepts, principles, and rules. It aims at providing individualized, fast, and detailed explanations and feedbacks. The intelligent advisor system MUSIC relates to the creation module of the grade 9 high school. Its purpose is to help a student while he or she uses a musical writing software to compose a melody.

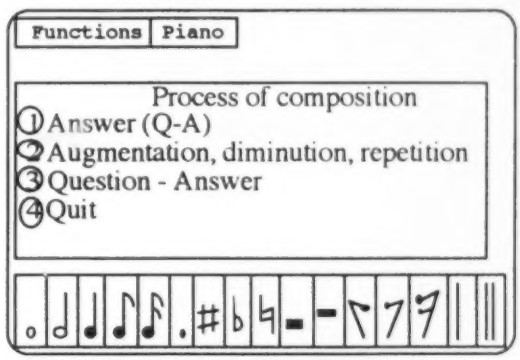

Figure 1. Activities Proposed

The Requirements

Ten years after the implementation of the music curriculum, many observed that the main objective of the creation module was not reached (Boulet, Dufour, & Lavoie, 1992; Fédération des Associations des Musiciens Éducateurs du Québec, 1990). Creation activities were not individualized, but group based. Students did not really transfer their own knowledge of the musical language elements. Consequently, we decided to develop the advisor system MUSIC.

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The Advisor MUSIC

There are three types of instructional transactions:

1. Explanations requested by a student in regard to musical language elements.

2. Comments on the student's composition.

3. Comments on compositions made up by the advisor.

Type 1

When students perform exercises MUSIC can help them by presenting explanations on prerequisites. The ability to use the question/answer process of composition being considered, the analysis of the music curriculum, and specialized books allowed the identification of 67 prerequisites and 29 rules (Boulet, & Dufour, 1991; Boulet, Dufour, & Lavoie, 1991a, 1991b).

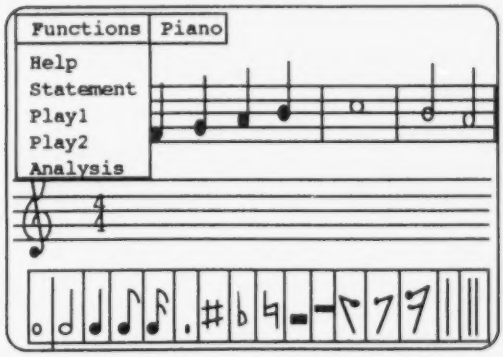

Figure 2. Functions Menu

For an explanation, the student merely selects the Help option in the menu Functions (Figure 2). The explanation requested is superimposed on the musical writing software (Figure 3).

As illustrated in Figure 3, there are underlined words within each explanation. They represent corresponding prerequisites. When a student clicks such a word with the mouse, the corresponding explanation is displayed.

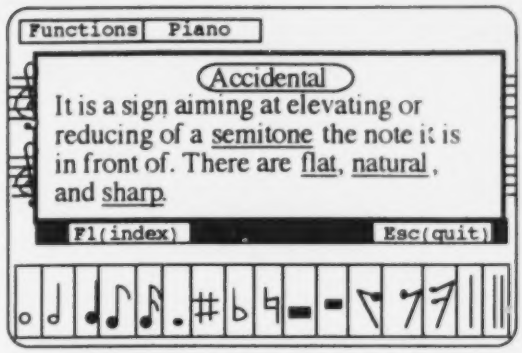
Functions
Piano
Accidental
It is a sign aiming at elevating or reducing of a semitone the note it is in front of. There are flat, natural, and sharp.
F1(index)
Esc(quit)

Figure 3. Explanation

The student can also see an index of all the explanations available, ask for one or more melodies related to a particular explanation, see a map of prerequisites, go back to the previous window, or go to the current composition activity.

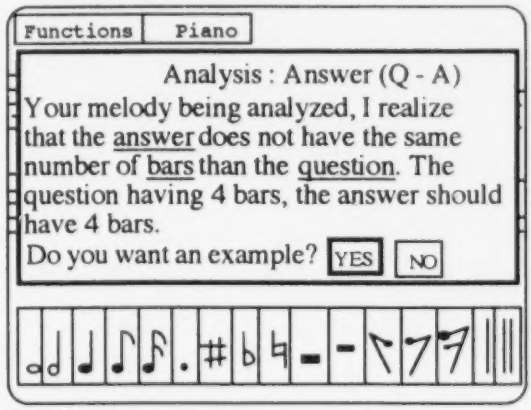
Functions
Piano
Analysis : Answer (Q - A)
Your melody being analyzed, I realize that the answer does not have the same number of bars than the question. The question having 4 bars, the answer should have 4 bars.
Do you want an example?
YES
NO

Figure 4: Commenting on Melody

Type 2

When a composition is completed, MUSIC can analyze it. Figure 4 presents an example. Here again, underlined words give access to prerequisites.

Type 3

MUSIC can also create a composition. If the student clicks on the "Yes" button illustrated in Figure 4, the advisor

composes. The advisor can also comment on its own composition. The comment will be similar to the one displayed to the student (Figure 4).

Purpose of the Study

The purpose of the study was to determine if the advisor favors the transfer of knowledge. Stated in the null form, the following hypothesis was tested:

Ho1. Students exposed to MUSIC will not show any significant improvement when transferring the knowledge of the musical language elements.

Procedures

Subjects

The subjects consisted of 27 voluntary ninth grade students from Quebec high schools (at the beginning there were 29; because of the attrition, only 27 completed the study).

Instruments

The validity and reliability of the test were established in two pilot studies (Boulet, Simard, Lavoie, & Dufour, 1991). 28 ninth grade students participated in the first. Results are summarized in Table 1. The Spearman Brown and KR_{20} both reached 0.9. We calculated factors of difficulty and discrimination and removed easy or non discriminant items. We reformulated certain items. The new version was tested on 51 ninth grade students. Results are summarized in Table 2. The Spearman Brown reached 0.9 and the KR_{20}, 0.8. Each item reached a satisfactory level of difficulty and of discrimination.

Results

For the pretest, the mean was 29.1%, with a standard deviation of 11.9. Results of the post test are the following: Mean = 66.2%, standard deviation = 14.5. A Two Group Paired t-Test was performed to verify the hypothesis: p = .00. Because the group realized a statistically significant improvement of the transfer of knowledge, the hypothesis was rejected.

Table 1
Pilot Studies Results

	Mean%	Std Dev	Spearman-Brown	KR20
1st	58.3	12.6	.9	.9
2nd	28	11	.9	.8

Discussion

Students improved the transfer of knowledge. We think that this result must be interpreted as the effect of the individualization. As mentioned before, music teachers have some problems with the creation module. Corresponding activities are rarely performed. Corresponding activities are not individualized. The advisor MUSIC does what is impossible for the human teacher of a class of thirty-three students, i.e., to perform concurrently the following tasks: for each learner's composition to generate adaptive, fast, individualized, detailed, remedial, and corrective explanations and feedbacks.

We also think that the way we implemented the advisor MUSIC had an influence on the results. We personally implemented MUSIC in its environment. Consequently, we were there to make sure that computers and technical features related would always be in order. We were there to make sure that the advisor will be used. Therefore, no technical problems interfered with the use of the advisor.

To conclude, we would like to recall that an advisor system does not aim at replacing formal teaching. It handles the issue of the transfer of knowledge. Other studies with different populations and different advisors will allow to learn more about the effectiveness of this particular kind of help.

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